

UNIQUE ENERGY MANAGEMENT TRAINING OFFERS CERTIFICATION AND ENERGY SAVINGS

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SUMMARY: The Northwest Energy Education Institute¹ (NEEI) has developed and presents a very unique energy efficiency training and certification program. Modeled after a similar course once offered in New Zealand, NEEI offers a two-week energy management certification program that requires students to place into practice what is learned in the classroom. Students who have completed the program show a significant return on investment for their training dollar and ongoing energy savings. This paper will present the Energy Management Certification² (EMC) program in detail and five case studies of students who have completed the program.

Keywords: energy management, energy management training, energy management certification.

INTRODUCTION: Energy Efficiency is rapidly becoming a mandatory practice in the maintenance departments of commercial buildings around the world. Driven by increasing utility rates and shrinking budgets, energy-cost savings are often a requirement rather than just a good idea.

Managers and administrators must know what to look for before initiating new energy efficiency projects or programs. Funds for energy efficiency cannot be wasted and the savings or payback must justify the project. Learning the nuts and bolts of energy efficiency has become the key to selecting the right project, stretching maintenance dollars and maximizing return on investment.

These strict conditions have led commercial building managers and administrators to look for energy training programs that offer personnel direct, hands-on experience in addition to classroom instruction.

Energy management/efficiency training and certification are looked upon as a way to inform practitioners of new products/protocol for identifying energy savings and validating their competency. Typically students attend a course or series of courses and, for certification, are evaluated to verify their understanding of the material. The most prominent US energy management certification is the Association of Energy Engineer's³ Certified Energy Manager⁴ (CEM) program where a combination of exam and work experience will qualify the practitioner for certification.

The NEEI Energy Management Certification (EMC) Program takes the certification process to a higher level by requiring the student to actually place into practice what is learned in the classroom. Students who pursue certification must implement an energy efficiency project identified by using the information presented within the EMC course. When completed, organizations which have sent employees to the EMC see a return on training dollar investment and ongoing energy savings past the initial project.

Organizational History: The Northwest Energy Education Institute (NEEI) began in 1997 as a component of the Lane Community College Energy Management Program⁵. The NEEI mission is to provide custom professional development opportunities for the energy efficiency industry in the Northwest region of the US. Funding for NEEI came in the form of a contract with the Northwest Energy Efficiency Alliance⁶ (NEEA) which is a consortium of public and private utilities as well as public interest groups. The mission of NEEA is energy efficiency market transformation.

NEEI has a number of certification programs that serve the utility and private sectors. Examples of NEEI certifications are the Bonneville Power Administration Residential Auditor/Inspector⁷ program and the Northwest Energy Efficiency Council's Building Operator Certification⁸, which is now offered in 12 states in the US.

¹ www.nweei.org

² www.nweei.org/emc.html

³ www.aeecenter.org/

⁴ www.aeecenter.org/certification/

⁵ www.lanecc.edu/instadv/catalog/science/programs/energy.htm

⁶ www.nwalliance.org

⁷ www.nweei.org/bpa.html

⁸ www.theboc.info/

The NEEI director consults with organizations regarding energy efficiency opportunities and organizational energy efficiency program development. NEEI is also involved with energy curriculum development nationally. The Partnership for Environmental Energy Education (PETE)⁹ contracted with the NEEI to provide technical assistance when developing a US national energy education curriculum specifically for community colleges. To date, Lane Community College is the only US community college to offer a two-year degree in energy efficiency.

METHODS: The EMC is a yearlong course-of-study developed and presented by NEEI. It begins with a pre-workshop assignment that students complete to familiarize themselves with basic information before they begin a two-week, in-residence block of instruction. The workshop is held at the University of Oregon where university campus facilities serve as the program laboratory. Participants stay at the university residency halls during the workshop.

During the in-residence block, students are immersed in energy efficiency fundamentals and practices. Because of the intensity of the in-residence portion of the program, students work extended hours, including evenings and a Saturday.

The in-residence block of study consists of the following topics:

Day 1 - Introductions and Overview

Day 2 - Energy Use in the Built Environment

Day 3- Lighting

Day 4 - Glazing, Insulation, and Building Envelope

Day 5 - Heating and Cooling Fundamentals

Day 6 - Secondary HVAC Systems

Day 7 - Controls Fundamentals

Day 8 - Electrical Fundamentals, Motors, and Variable Frequency Drive Applications

Day 9 - Plant Equipment

Day 10 - Energy Auditing I

Day 11 - Energy Auditing II

Students return to their place of employment at the conclusion of the in-residence block. With Institute and employer assistance, students develop, implement, and measure a workplace project. During the program year, students gather quantifiable data on their projects. At the year's end, students give a written and verbal presentation to practitioners currently attending the in-residence portion of the program, their program peers and Institute staff.

Students who have completed the program, and there are many, are very pleased with the high quality of instruction and support they receive when implementing their projects at their workplace. The program faculty consists of industry practitioners who have the unique ability to relate their vast field experience.

The most unique part of the EMC is the high probability return on investment potential when the student's project is implemented.

A tradition that began three years ago is the EMC Speaker Series. EMC students have an honored seating position at a community lecture given by internationally respected authorities on energy efficiency and design. Bill McDonough, Principal and Founder, William McDonough and Partners¹⁰ and best selling author Paul Hawken¹¹ are past presenters. The guest presenters attend an EMC classroom session to discuss in detail ideas and concepts offered at the community lecture.

RESULTS: In April 2003 the NEEA contracted with Currents Consulting to evaluate the NEEI, specifically the EMC. Currents Consulting, therefore prepared "Market Progress Evaluation Report #3"¹². The evaluation produced five EMC project case studies which are presented below.

NORTH SANTIAM SCHOOL DISTRICT¹³

BACKGROUND

Title and Energy-Related Responsibilities of Course Participant: As Maintenance Mechanic/Energy Coordinator with the North Santiam School District, the course participant is responsible for all aspects of maintenance and energy management for two combined elementary and middle schools, one elementary school, one middle school, one high school, District offices, and all other structures located on the District grounds.

⁹ www.ateec.org/pete/programs/programs.htm

¹⁰ www.mcdonough.com

¹¹ www.naturalcapital.org/ph/Intro/intro.html

¹² Northwest Energy Education Institute, Marketing Progress Evaluation Report #3 Report #E03-112, Currents Consulting, April, 2003

¹³ www.northsantiamsd.com

Facility/plant type: The participant completed projects at an elementary school and a middle school for his EMC coursework.

Enrollment: The participant's supervisor heard about the course through a mailing and encouraged the participant to take the course. The supervisor himself had attended a similar energy management course in California and had found it very beneficial. The supervisor knows this staff person as a highly motivated self starter with a keen interest in continuing education and professional development, and so thought he would be a perfect candidate. The participant himself heard about the course at the 2001 Oregon School Facilities Managers Association (OSFMA) convention held in Eugene, Oregon. The participant arranged for funding himself seeking out and obtaining a \$1,000 scholarship from PacifiCorp and receiving an "early bird" registration discount of \$500. With the fee reduced to \$2,000, the participant was able to convince the superintendent to fund the balance through District training monies. The time commitment was not a problem for the participant as the course took place during the summer.

COURSE PROJECTS

Course Project Description: The course participant identified the project opportunities by analyzing billing information to determine which buildings had the highest usage and then performing facility walk-throughs along with the contractor hired to implement the projects. The projects for the EMC course included the following energy saving measures/actions and were completed by October 2002.

- Elementary school: Lighting retrofits including compact fluorescents, electronic ballasts, T-8s, metal halide lamps, and LED exit signs. Daylighting was also used. A distributed digital control (DDC) upgrade was performed on eight roof top units, one air handler, 23 finned tube radiators, and one low-pressure steam boiler. The equipment is all controlled by a main control panel that in turn reports to a central computer running software designed to accommodate activities such as trending and custom scheduling.
- Middle school: Lighting retrofits including compact fluorescents, electronic ballasts, T-8s, metal halide lamps, and LED exit signs. Also performed a controls upgrade involving demolition of the existing pneumatic control system and installation of a DDC system on 6 multi-zone units, three air handlers, and one hot water boiler. The centralized control and scheduling features are the same as those described above for the elementary school.

Annual Energy and Cost Savings¹⁴: Estimated Annual Energy Savings for All Projects: 425,700 kWh and 27,600 therms. Estimated Annual Cost Savings: \$21,500 electricity savings and \$12,000 gas savings. Electricity and gas consumption are both down by 30%.

Non-energy Benefits: Occupants report they are more comfortable. There is better control of ambient temperature and the levels and quality of lighting are greatly improved (including elimination of buzz and flicker). The participant is developing a formal plan to track test scores before and after retrofit to assess whether the retrofits have measurable impacts in this regard. Extended equipment life and reduced maintenance from both the equipment retrofits and the installation and programming of the centralized control system.

"Spillover" Projects and Activities

Below is a description of projects and activities led by the participant after he attended the course that go well beyond the specific work completed to meet the course requirements.

Spillover Project Description:

- Installed vending misers on seventeen vending machines (approximate annual cost savings of \$2,000 based on estimates by the maintenance staff).
- District-wide adjustment of HVAC set points.
- An aggressive preventive/predictive maintenance program.
- Annual summer shutdown of all non-essential equipment, i.e. HVAC, freezers, refrigerators, limited lighting only for essential work crews. (The maintenance staff estimated that the summer shutdown saved \$19,500 in utility costs alone in its first year.)
- Education of District staff on simple energy saving measures.
- Development of a 5-year energy efficiency plan. Phase I consists of the projects above. Phase II will include a DDC upgrade and a lighting retrofit at the District high school. Phase III will be the design of two new schools utilizing energy efficient construction design.
- Launch of a program whereby all equipment purchased by the District will be Energy Star.
- Potential District-wide installation of controls software to maximize savings.

¹⁴ As estimated by the course attendee.

Annual Energy Savings: The maintenance staff will continue to monitor energy and costs savings as their budget allows.

Non-energy Benefits: Non-energy benefits are expected to be similar as those described above for the middle and elementary school projects. In addition, implementing both the 5-year efficiency plan and the Energy Star program will help streamline equipment purchase decisions.

ORGANIZATIONAL AND PERSONAL BENEFITS OF THE EMC

Benefits Within and Beyond the Organization: The school district now has a staff person with the skills and knowledge to lead energy efficiency efforts and oversee the work of contractors. The contract for the school retrofits was about \$500,000. It was complex and required the participant to conduct considerable review and negotiation at the outset, and do hands-on project management throughout implementation.

The estimated annual electricity and gas cost savings from the energy projects are saving more than \$40,000 per year. These annual savings, in combination with tax credits, rebates, and low interest loans, are more than covering the loan payments, thus making the projects revenue-positive. In addition, the initial capital investment by the District was only \$30,000 on a \$491,000 project. This was key to winning Board approval.

The participant is a team player willing to share his knowledge from the course with others on the District maintenance team. He is currently helping a fellow staff person gain skills to oversee the Phase II project described above.

The course was particularly valuable in helping the participant identify additional opportunities in operations and maintenance as part of the measures proposed by the contractor. The participant's supervisor remarked: "We did things right the first time and that was a result of the course."

This staff person was already a highly motivated self-starter before the course, but the course gave him new tools and an even higher level of commitment and confidence. His productivity, and in turn his value to the District, increased markedly following the course because of what he learned.

The District School Board gained a new understanding and appreciation of the importance of life cycle cost analysis. As the participant's supervisor remarked, the board has "put their arms around" this approach.

Praise and recognition for efforts by the District School Board were received in a school board meeting open to the public.

Personal and Professional Benefits for Participant: The knowledge, skills, and confidence to become a leader in identifying, analyzing, prioritizing, and implementing energy efficiency projects at the District. Knowledge and confidence to oversee and check contractors' proposals and on-site work.

Presentation Skills: Presented to the Santiam School Board and convinced them to fund his projects.

Enhanced Skills in Financial Analysis: The participant used the EMC spreadsheet to do the financial analysis that indicated that the cost savings (about \$40,000 per year) from his proposed energy efficiency projects, in combination with tax credits, rebates, and low interest loans, would cover the loan payments, thus making the projects revenue neutral. In addition, the initial capital investment by the District was only \$30,000 on a \$491,000 project. This analysis was key to winning Board approval. In fact, savings are turning out to more than cover the loan payments. He recently provided a project update to the Board and received kudos.

Increased Responsibility: The participant highly values opportunities to continue to build his knowledge. He recently attended a training on the controls software to be used at the schools. The software includes security, fire alarm enunciation, and lighting. The software will also trend failure for equipment and predict failure. The District may replace equipment proactively to maximize savings.

Recognition and encouragement by his supervisor, other staff, and the District board.

Verbatim Remarks: The participant commented that "The instructors were just stupendous. Support from NEEI staff was superb and very professional both the instructional guidance and equipment such as data loggers. The staff at NEEI was very accessible... The program and preparation [for completing our projects] were fantastic. I especially appreciated the training in using my powers of observation and paying attention to details where energy savings could occur." The participant's supervisor said, "His overall work performance improved because the course gave him an avenue to improve his work."

OREGON STATE DEPARTMENT OF ADMINISTRATIVE SERVICES¹⁵

BACKGROUND

Title and Energy-Related Responsibilities of Course Participants:

The projects completed at the Oregon State Department of Administrative Services (DAS) involved the collaboration of two course participants: the Statewide Resource Coordinator with DAS and an Energy Analyst with the Oregon Office of Energy (OOE).

Facility/Plant Type: The projects for the course were at an office building and a printing plant.

Enrollment: The supervisor of the DAS participant wanted to expand the recycling program to include energy and other resource efficiency. The participant had been managing the recycling program but needed more technical background in energy efficiency to help her coordinate an all-resources program. The EMC course was brought to the attention of the supervisor by a staff person in the DAS O&M group who had seen it on the Internet and the supervisor approached the participant about going. In the case of the participant from OOE, this office has a working relationship with the Northwest Energy Education Institute so the participant was aware of the course and decided to take it to further develop his technical knowledge of energy efficiency to supplement his project management skills.

COURSE PROJECTS

Course Project Description: The projects completed for the course involved the following electricity saving measures:

State of Oregon “Real Estate” Building:

- Eliminated four hours from the building operation schedule;
- Converted lighting to T-8s;
- Delamped where lighting levels were found to be excessive;
- Began turning office machines off on weekends and holidays;
- Installed new programmable thermostats;
- Raised temperature set points in the cooling season;
- Eliminated special A/C units for computer room;
- Installed occupancy sensors in certain areas.

Some of the HVAC-related measures described above have also helped cut gas consumption during the heating season as the building is heated with natural gas.

State of Oregon Print Plant:

- Delamped in selected office areas.
- Gas savings were achieved by lowering temperature setpoints (building is heated by a gas-fired boiler).

Annual Energy and Cost Savings¹⁶: Energy savings were determined for four measures in the office building (delamping, conversion to T-8s, occupancy sensors, and elimination of special A/C units) and one measure in the print plant (delamping).
Estimated Annual Energy Savings: 120,600 kWh
Estimated Annual Cost Savings: \$13,300

Non-Energy Benefits:

- Better light quality and levels.
- Improved comfort of building occupants.
- Extended equipment life and reduced maintenance.

“Spillover” Projects and Activities

Below is a description of projects and activities led by the participant from DAS that were influenced by the course, but go well beyond the specific work completed to meet the course requirements.

Spillover Project Description:

- Electricity saving measures were implemented in 36 DAS-owned and four DAS-operated buildings.
- De-lamping over 18,000 lamps in the DAS buildings, grounds, and parking structures.
- Decreasing the electric heating system run times by 3 to 5 hours and adjusting thermostat settings by 3 to 5 degrees.
- Reducing temperatures for electric water heaters to 120 degrees.
- Asking employees to remove space heaters and other private appliances.

¹⁵ www.das.state.or.us/

¹⁶ As estimated by the course attendee

- Increasing employee awareness of plug loads, including asking employees to turn off computers, monitors, and task lights when not in use.
- Installing “Vending Misers” on all cold beverage machines where possible.

Several of the measures above also reduced gas usage in buildings with gas heating systems (decreased run times and thermostat adjustments) and water heaters (temperature reduction).

In addition, the following projects are completed or in process:

- **DAS Public Utility Building:** The participant is working with an engineer to develop a plan to replace an outdated HVAC system that uses an underground well pump to provide water to a single-pass cooling system. The project will reduce demand spikes as well as save energy and water.
- **DAS Supreme Court Building:** The participant is working to correct a poor load factor and reduce demand spikes caused by an outdated heating system. This situation is exacerbated by the fact that the current accounting system does not allow DAS to charge back for demand.
- **DAS L&I and Revenues Buildings:** The participant is working with the consulting firm that is doing a system upgrade to make sure the firm’s engineers have all the necessary data to design an energy efficient retrofit.
- **DAS Employer Building:** The DAS participant worked on the agency’s first project involving an energy services company (ESCO), and was responsible for verifying the ESCo’s savings guarantee.
- **DAS Policy On Water and Energy Conservation:** The participant helped prepare this unique policy that includes personal appliances (e.g., space heaters, office refrigerators, and Christmas lights). Her involvement in the policy was possible because the course enabled her to move from a clerical position with the recycling program to a professional position with the all-resource program. She researched about half of the energy saving items in the policy to assess their feasibility and energy savings. As the participant said “before the [EMC] course I wouldn’t have even known what to research.” She reviewed policy drafts and was active in the policy planning committee of 20 agencies that own and manage land and property. Altogether, these 20 agencies oversee 32 million square feet of property of which DAS property comprises 3 million square feet. Her research and involvement were key in making the policy as thorough as it is. The policy has in turn been adopted by other jurisdictions as word has spread and it has become available on the State’s web site. For example, the City of Eugene, Oregon, and Multnomah County in Oregon have both adopted it. In the latter case, another participant of the EMC course heard about it from his fellow classmate and pushed for the County to adopt it when he took his new position there as Energy Conservation Specialist. Agencies from other states have also called to ask to use it.
- **DAS Quarterly Newsletter:** The newsletter has been broadened to include energy efficiency
- **State Sustainability Policy:** The DAS participant helped write the “green” building portion of the policy which impacts construction, deconstruction, renovation, new leases, and deconstruction.
- **State of Oregon Resource Team:** The DAS participant coordinates this team comprised of resource coordinators from 15 different state agencies. Following attendance at the course, the DAS participant broadened the group’s focus from recycling to include energy and water conservation. The DAS participant describes the committee members as “my eyes and ears of energy issues in state buildings.” The members have helped identify opportunities for lighting and HVAC savings, as well as helped with plug load education among building tenants.

Annual Energy and Cost Savings: The new DAS policy on water and energy conservation, along with the other specific projects described above and improved O&M have helped DAS reduce electricity consumption in the 3 million square feet it owns and manages by about 20% in the last two years as compared to its year 2000 usage. This represents annual savings about 10,000 MWh or 1.14 aMW based on billing analysis conducted by the participant. (Note that these have not been formally audited and are not weather adjusted.)

Non-Energy Benefits:

- Better light quality and levels.
- Improved comfort of building occupants.
- Extended equipment life and reduced maintenance.

ORGANIZATIONAL AND PERSONAL BENEFITS OF EMC COURSE

Benefits Within and Beyond the Organizations:

- **DAS: Staff Development and Program Expansion:** The course provided the participant the knowledge needed to expand the DAS recycling program to include energy efficiency, help prepare the DAS policy on water and energy and the state sustainability policy, and expand the State of Oregon Resource Team's responsibilities to include energy.
- **DAS: Success in meeting the Governor's Call for Energy Conservation:** The participant is now responsible for tracking the progress of DAS towards meeting the 2001 Governor's Call for Energy Conservation calling for state agencies to cut their energy consumption 10% over the year 2000 baseline.
- **Oregon Office of Energy: Staff development:** The course enabled the participant to gain technical knowledge to be more comfortable and skilled in his job.

Personal and Professional Benefits For Participants:

- **DAS Participant:** The course enabled the DAS participant to move from a clerical position with the recycling program to a professional position with the all-resource program and take on substantially more responsibility and challenge.
- **DAS Participant:** Because of the EMC course, the participant now has more technical knowledge to support her energy efficiency recommendations to the O&M group. Her increased knowledge has enhanced the O&M group's respect and trust, and has led to more follow-up on her suggestions. The participant also feels she can now more actively participate in O&M staff meetings and offer suggestions.
- **OOE Participant:** The participant already had program management experience but as a new employee at OOE he needed more technical knowledge about energy efficiency to do particular aspects of his job such as reviewing Business Energy Tax Credit (BETC) applications.
- **OOE Participant:** The participant was specifically looking to develop his knowledge of energy auditing and believes the course met his needs well in this area.
- **OOE Participant:** The participant specifically mentioned the benefits of having access to the instructors and forming a close-knit student group for later communication and assistance.

Verbatim Remarks: "The instructors were great. They were obviously really knowledgeable in their field. Roger picked people who were top notch. It impressed me that we had so many good people." *DAS participant.*

TIGARD-TUALATIN SCHOOL DISTRICT¹⁷ AND MULTNOMAH COUNTY PROPERTY MANAGEMENT DIVISION¹⁸

BACKGROUND

Title and Energy-Related Responsibilities of Course Participant:

At the time he attended the EMC course, the participant was Energy Manager with the Tigard-Tualatin School District. He was responsible for all aspects of maintenance and energy management for nine elementary schools, three middle schools, and two high schools. He is now Energy Conservation Specialist in Environmental Services with the Facilities and Property Management Division of Multnomah County. He is responsible for identifying, assessing, and implementing energy-efficiency related projects in 120 owned and leased facilities totaling 3.7 million square feet. Facility types include libraries, health clinics, correctional facilities, road maintenance shops, and general office space. He works cooperatively with staff throughout the county, particularly maintenance, and also works on projects with the County's Manager of Sustainability.

¹⁷ www.ttsd.k12.or.us

¹⁸ www.co.multnomah.or.us/dbcs/facilities

Facility/Plant Type: The participant completed three lighting efficiency projects specifically for the EMC course in his previous position as Energy Manager at the Tigard-Tualatin School District. The projects were at a high school, a middle school, and a swim center. In his current position with Multnomah County, the participant has already completed numerous additional energy efficiency projects in various facility types including retro-commissioning on a correctional facility, a large lighting retrofit, and multiple small lighting retrofits. His major ongoing focus is on staff behavior modifications as mandated through the County Energy Policy.

Enrollment: The participant saw a flyer on the course and his attendance was funded from the school district's general funds.

COURSE PROJECTS

Course Project Description: The projects at the Tigard-Tualatin School District completed for the EMC course included the following energy saving measures/actions implemented in summer 2000:

- **Middle School Gym:** Replaced 50 750-watt incandescent fixtures with 38 400-watt metal halide fixtures.
- **High School Gym:** Replaced 31 400-watt mercury vapor fixtures with 21 400-watt metal halide fixtures with clear acrylic refractors to bounce light off the ceiling, and replaced 2, 300-watt incandescent night lights with 2, 40-watt compact fluorescents.
- **Swim Center:** Replaced 18, 400-watt mercury vapor down light fixtures with 18, 250-watt metal halide fixtures with clear acrylic refractors to bounce the light off the ceiling. Eight, 400-watt flood lights were eliminated that had made seeing the bottom of the pool difficult.
Replaced two electric-fired boilers with gas-fired boilers.

Annual Energy and Cost Savings¹⁹:

Estimated Annual Electric Energy Savings for All Projects: 94,700 kWh⁹

Estimated Annual Cost Savings: \$4,750

Overall, the participant achieved a 20% reduction in electricity and gas consumption and a 10% reduction in water consumption during his tenure with the School District.

Non-Energy Benefits:

- Dramatic improvement in the middle and high school gym lighting levels and evenness.
- Improved safety at the swim center by reducing glare that had obscured the pool bottom.
- Reduced maintenance of lighting systems.

“Spillover” Projects and Activities

Below is a description of projects and activities led by the participant after he attended the EMC course that go well beyond the specific work completed to meet the course requirements. In this case, spillover effects are being achieved through the participant's efforts in his new position with Multnomah County. (A change in management at the Tigard-Tualatin School District has led to reduced support for energy management activities there. Since the participant's departure, the new management has not brought in a new staff person, so energy efficiency efforts have slowed.)

Spillover Project Description:

- **Retro-Commissioning** on a correctional facility.
- **Lighting Retrofits:** A large lighting retrofit and multiple small lighting retrofits.
- **Improved Use of the DDC System:** The DDC system now links over 40 county facilities of various types, providing real-time energy data and remote control capabilities. A system-programmed holiday shut-down procedure has been implemented.
- **County Energy Policy:** The participant together with the Manager of Sustainability recently rewrote the County Energy Policy. The policy focuses on mandatory behavioral changes such as turning off computers and lights and eliminating personal space heaters, and also includes temperature set-points.
- **Use of EMC Course Spreadsheets as County Standard:** The life-cycle cost analysis spreadsheets provided in the course have become the standard tool used by the County to analyze energy project benefits and costs.
- **Energy Management Software User Group:** Five students from the course formed a user group for energy management software (Utility Manager 4.0) that meets quarterly and brings technical staff out for trainings.
- **Outreach to Build EMC Course Attendance:** The participant is working with other organizations such as the Oregon Energy Office and Portland General Electric to help fund enrollment of other students in the course.

¹⁹ As estimated by the course attendee

Annual Energy and Cost Savings: The participant is in the process of estimating energy savings from the projects and efforts described above.

Non-Energy Benefits:

- **Lighting Retrofits:** Improved lighting quality and reduced maintenance.
- **DDC System:** Real-time monitoring and remote control of facility energy usage. This streamlines energy usage monitoring and should boost energy savings over time.
- **Use of EMC Course Spreadsheets As the County Standard:** This has improved the sophistication with which energy projects are analyzed, and has made consideration of life-cycle cost analysis integral to decision-making.

ORGANIZATIONAL AND PERSONAL BENEFITS OF EMC COURSE

- **Benefits Within and Beyond the Organization:** The County has a skilled and motivated staff person to lead energy efficiency efforts and oversee the work of contractors. The particular skills and knowledge gained in the EMC course make a powerful combination with the participant's natural entrepreneurial and problem-solving abilities, and his experience and perspective from working at all organizational levels and with all types of staff. He also knows that understanding an organization's management structure, decision-making process, and perspective/concerns is critical to successful energy projects. For example, he observed that county correctional facilities are run in a military style and adjusted the DDC system to match that scheduling. In another example, the participant requested permission to make a required maintenance check of fire extinguishers at county facilities, and while he was there took the opportunity to talk with staff about energy efficiency and assess project opportunities. Had he not linked the energy assessment to a safety check, he might not have been able to gain an audience.
- **Personal and Professional Benefits for Participant:** The participant said the EMC course was a critical factor in being selected for his current position with the County, and in his success so far in completing a number of projects and initiatives. He believes the hands-on project work in the course and the training in doing calculations was particularly valuable.

The participant thought the half-day on presenting and selling energy projects at different organizational levels was particularly useful. He learned how to analyze project benefits and costs and present those results to both management and maintenance in terms they could understand and relate to.

Camaraderie among students has been very valuable. They often see each other in professional meetings and share ideas. Five of them have formed a user group for their energy management software.

Verbatim Remarks:

- *Participant:* "[The course] hit the mark on everything. Calculations, selling the project, programmatic. You had enough [information] to talk the talk but you could also find someone to help you. We're building an environmental kingdom here [at the County]. It was a great program. I talk about it still. It was a fun learning experience and challenging."

OREGON PARKS AND RECREATION DEPARTMENT²⁰

BACKGROUND

Title and Energy-Related Responsibilities of Course Participants:

Two staff people from the Oregon Parks and Recreation Department (OPRD) attended the EMC course.

- One participant was the Energy Conservation Engineer with OPRD. This staff person's current responsibilities include coordinating the energy efficiency-related aspects of field projects, as well as managing overall project documentation, permitting, and construction. She tracks the OPRD's utility consumption including energy, gas, oil, water, and wastewater using a utility management program. She is part of a facility planning group that identifies and recommends projects involving energy efficiency. Her position changed in the wake of attending the course to include broader programmatic work (rather than individual projects) and having a greater focus on energy efficiency.
- Prior to attending the course, the other staff person was a Design Engineer focusing on the civil engineering aspects of project design. Following course completion, he was promoted to Programs and Facilities Maintenance Lead and his responsibilities were expanded to include oversight of all resource efficiency aspects of projects including designing comprehensive projects such as "Green Buildings," reviewing plans provided by field staff for equipment retrofit and sending out and reviewing bids. He is also part of the facility planning group described above.

²⁰ www.prd.state.or.us

Facility/Plant Types: The participants completed course projects at a wide range of OPRD facilities including the park administrative headquarters in Salem, park historic buildings, meeting and dining facilities, and campground facilities such as cabins, restrooms, and showers.

Enrollment: The participants' supervisor made a "two for one" arrangement with the EMC course director and approved the funding.

COURSE PROJECTS

Course Project Description: Twenty-four projects were completed during the 1999-2001 biennium and reported on as part of the EMC course. These projects addressed a number of different "utilities" including electricity, water/sewer, propane, stove oil, diesel, natural gas, and solid waste. They are part of a broad and deliberate effort to bring the OPRD along a path of sustainability in its operations; this effort includes a goal of 25% energy reduction by the year 2009 (based on year 2000 usage). The twenty four projects included 42 different measures related to resource efficiency and sustainability. Twenty five of those measures involved electricity savings as follows: seven lighting measures, seven shell measures in electrically heated buildings, one electrical equipment O&M measure, one heating, ventilation, and cooling measure, and nine water conservation measures. The water measures save electricity by reducing energy used to pump well water into the facilities and wastewater out to the drainfields. The remaining 17 measures reduced usage of other resources such as natural gas, propane, and wood (by using building materials made from recycled plastic, for example).

Annual Energy and Cost Savings:²¹ Electric energy savings were calculated by the course participants for two of the electricity related efficiency measures. Both were lighting projects in existing buildings (OPRD headquarters and facilities at Nehalem Bay State Park), and totaled estimated savings of 265,200 kWh. Savings for the other electricity-related measures were not calculated because they involved new construction or other circumstances that made it difficult to establish a baseline and make meaningful comparisons. (Total gas savings of 4,800 therms were also calculated for several other projects.)

Non-Energy Benefits:

- Better light quality and levels particularly in the OPRD headquarters.
- Improved comfort of occupants and state park visitors and campers.
- Extended equipment life and reduced maintenance.

"Spillover" Projects and Activities

Below is a description of ongoing projects and activities that are influenced by the EMC course, but go beyond the specific work completed to meet the course requirements.

Spillover Project Description:

- **Building Retrofits:** The OPRD is retrofitting 25 restrooms around the state. Measures include replacing incandescent lighting with fluorescents, installing occupancy sensors, retrofitting toilets, and installing metered showers and faucets. A number of old water heaters are being replaced with new energy efficient propane heaters, and one propane water heater is being replaced with a solar water heating system. These projects are to be completed by June 2003.
- **Enhanced Utility Tracking and Reporting:** Tracking and reporting of electricity and gas usage became a state requirement in 2001, and the EMC course has helped the participants optimize their use of the "Z-Power" tracking software to track multiple utilities. One of the course participants is responsible for developing the Z-Power database of billing and equipment information. They are currently tracking electricity, natural gas, propane, and water/sewer, and plan to add solid waste. The data from Zpower are compiled by the OPRD Assistant Director into a formal report to state legislators.

Annual Energy Savings: Annual energy savings figures were not available yet for these spillover projects as they are still in process.

Non-Energy Benefits:

- **Building Retrofits:** Extended equipment life and reduced maintenance.
- **Z-Power Tracking Software:** This tool will greatly streamline the process of resource tracking and should lead to greater reductions in usage.

ORGANIZATIONAL AND PERSONAL BENEFITS OF EMC COURSE

²¹ As estimated by the course attendee

Benefits Within and Beyond the Organization:

- Greater Staff Competency In Energy Efficiency:** The two participants gained greater competency in identifying, analyzing, recommending, and ultimately managing the implementation of energy efficiency projects at the OPRD. Their skills were strengthened in facilities auditing, building component and equipment research and specification, equipment sizing, and life-cycle cost analysis. With these skills, the participants also can more effectively review contractors' bids, equipment selection, and on the-ground work. In one case, one of the participants challenged the recommendation made by an outside engineering firm for a particular water heater. Her alternative recommendation involving extensive research and life-cycle cost analysis, won out as the better choice in terms of energy and costs savings and maintenance, as well as needed capacity. Specific information provided by the EMC course on lighting design and lighting levels has also been particularly valuable in equipment specification. One participant is getting additional training through PGE on new lighting technology innovations.
- A Thought Process Change:** The participants' supervisor believes the "immersion" approach of the EMC course is key to changing participants' thought processes and perspective so they view projects through an energy efficiency "lens." He remarked that the participants form the core of an OPRD working group that "acts as the [organization's] conscience for energy efficiency." He is in the process of encouraging staff to change their mindset even further in terms of assessing sustainability projects using life cycle cost analysis, net present value, durable cost analysis, etc.
- Better Ability to Present Project Merits to Management:** With better analytical skills the participants can recommend projects to managers based on life-cycle cost savings. This increases the likelihood managers will approve the projects even if first cost may be higher.
- More Effective Negotiation Of Purchase Of Efficient Equipment:** Because of the EMC course, the participants are more effective in negotiating the state's contracting process to make sure equipment with optimal efficiency is purchased and, in some cases, that specific brands are specified. The EMC course training in life-cycle cost analysis and equipment specification is critical as the OPRD staff must have a high degree of confidence in their assessment of the equipment's energy savings and performance.
- Ability to Respond to Oregon's Sustainability Mandate:** The two EMC course participants form the core of the OPRD sustainability team, and energy efficiency is integral to their efforts. The participants' training is helping them respond to the Governor's Executive Order on Sustainability (issued in May 2000) that mandates all state agencies to develop policies and programs for achieving sustainability (as defined in the mandate) by 2025.
- State Wide Recognition For Sustainability Efforts Including Energy Efficiency:** The Field Operations division of the OPRD won the State of Oregon 2001 Resource Steward of the Year award. The Field Operations division includes all state parks and the OPRD engineering section. The award recognizes the OPRD's sustainability efforts including energy and water efficiency, recycling, and sustainable design and construction. This award is given by the Oregon Department of Administrative Services (DAS) Resource Conservation Management Program. It was a fellow EMC course participant with DAS who nominated the OPRD. The OPRD was also recently given an award for sustainability from the National Prefabricated Building Association.
- Enhanced Ability to Motivate and Gain Support o Other Staff:** The participants' EMC training has bolstered their knowledge and enthusiasm. In turn they have been able to motivate other OPRD staff to help them with their projects and identify other saving opportunities. They have also been able to garner the support and trust of park rangers and other facilities maintenance staff because so far the equipment the participants have recommended is requiring less maintenance and is more reliable. One example is the new Voyager-brand water heaters; facilities staff were initially skeptical but have become enthusiastic supporters. This trust is invaluable as facilities staff are critical in maintaining savings, and identifying new savings opportunities. The participants also give presentations at park meetings to share information and hear feedback.
- Leadership in Department-Wide Sustainability:** One of the participants now heads up a committee at the OPRD whose charge is to develop a list of energy efficient and sustainable projects.

Personal and Professional Benefits for Participants:

- Knowledge, skills, and confidence to become leaders in sustainability projects including energy efficiency at the OPRD.
- For one participant, the course was instrumental in his promotion from Design Engineer to Programs and Facilities Maintenance Lead as described earlier. The course led to expansion of responsibilities for the other participant as well.

- Presentation skills and confidence. The participants present recommended projects to the OPRD managers and report project progress and results at the monthly all-staff meetings. This information is also reported in the “FYI” e-mail that goes out to all staff.
- Direct recognition through staff support and indirect recognition through the formal awards described above.

CITY OF PORTLAND BUREAU OF ENVIRONMENTAL SERVICES²² – WASTEWATER TREATMENT PLANT

BACKGROUND

Title and Energy-Related Responsibilities of Course Participant:

The title of the participant is Lead Electrician. He is responsible for all aspects of electrical maintenance at the wastewater treatment plant including energy efficiency. At the time this case study was prepared, he was spending about one quarter of his time on energy efficiency. However, an effort is underway to allow him to devote more of his time to energy management.

Facility/Plant Type: City of Portland, Bureau of Environmental Services Wastewater Treatment Plant located in North Portland.

Enrollment: The participant’s supervisor heard about the course from his utility representative. The participant had shown strong prior interest in energy-related issues and projects so his supervisor asked him if he would like to attend. Funding came from a combination of in-house training monies and a utility rebate on the course cost. In-house funding was not difficult to obtain.

COURSE PROJECTS

Course Project Description: The projects completed for the course included six energy saving measures/actions implemented from March through June of 2002:

- **Deepwell Pump:** Use of a lubricating oil additive in a pump to improve efficiency.
- **Headworks Heating and Ventilation System:** Calculation of required air changes for motor room led to elimination of one-half of the air handlers, and operation of the remaining air handler fan is at reduced speed.
- **Sludge Hopper Facility Lighting:** Installation of photocells reduced hours of operation by one-half for high-pressure sodium fixtures.
- **Work Facility Lighting:** Replacement of 116 high bay high intensity discharge fixtures with 91 T-5, 4-lamp fluorescent fixtures. Project took advantage of utility rebate program.
- **Occupancy Sensors:** Occupancy sensors (including sensors for air motion and movement) were installed in 78 locations where they would not compromise work safety. The project took advantage of an existing utility rebate program.
- **Tunnel Lighting Modifications:** Better scheduling of T-8 lighting use coupled with timed switches and delamping where appropriate.

Annual Energy and Cost Savings²³:

- Estimated Annual Electric Energy Savings¹⁰ for All Projects **Above:** 439,400 kWh
- Estimated Annual Electric Energy Cost Savings: \$26,000
- Average Simple Payback: 1.8 years

Non-Energy Benefits:

²² www.portlandonline.com

²³ As estimated by the course attendee

- Work facility lighting upgrades resulted in improved lighting levels and lighting quality. Staff remarks: “It’s great, I don’t need as many fixtures as before.” “It’s like a breath of fresh air.” “I think it’s absolutely great.”
- More efficient lighting resulted in reduced maintenance time and costs for lamp and ballast replacement.
- Occupancy sensors eliminated need to monitor and turn off lights manually.

“Spillover” Projects and Activities

Below is a description of additional projects and activities that were influenced by the course, but go well beyond the specific work completed by the participant to meet the course requirements.

Spillover Project Description:

- **Sophisticated Real-Time Monitoring Capabilities:** The class participant is helping lead an effort to install web-based, real-time energy monitoring equipment for the entire wastewater treatment plant. This will greatly enhance staff’s ability to track overall energy use, measure pre- and post-project usage, and identify opportunities for further reduction. The motor control centers and large individual motors will be monitored. The participant is tailoring generic web pages to create a user-friendly interface for plant operations staff and managers. Portable energy monitoring equipment will also be used.
- **Screenhouse Building Lighting Retrofit:** The participant is removing 49 400-watt metal-halide fixtures and installing 25 fluorescent fixtures equipped with 2 T-8 lamps.
- **Sludge Processing Building:** The participant is in the process of assessing potential savings from lighting retrofit opportunities. These will qualify for a power company rebate of approximately 29%.

Annual Energy Savings:

- Estimated Annual Electric Energy Savings: 13,500 kWh for the screen house retrofit and 72,100 kWh for the sludge processing facility.
- Estimated Annual Electric Energy Cost Savings: \$850 and \$4,550 respectively.

Non-Energy Benefits:

- Higher lumens of light per square foot.
- Safer working conditions.
- Reduced cost for replacement lamps and ballasts.
- The ability to have instant-on lighting capability.

ORGANIZATIONAL AND PERSONAL BENEFITS OF EMC COURSE

Benefits Within and Beyond the Organization:

- **Development of Leadership In Energy Efficiency:** The course helped build the participant’s skills and knowledge to lead energy efficiency efforts within and beyond his facility. At the time this case study was prepared, he was spending about one quarter of his time on energy efficiency, but staffing arrangements were being made to enable him to spend more time on energy management.
- **Recognition of Energy Efficiency Efforts:** The participant has presented his projects to in-plant staff and in turn has been recognized within the Wastewater Group for his efforts. His supervisor regularly reports to fellow managers to maintain support and interest, and generate additional ideas. The participant has also presented to BES staff and the Association of Professional Energy Managers.
- **Ever-Broader Involvement of Other Plant Staff** in identifying, planning, and completing energy efficiency projects. Of particular value is having this person at the staff level sharing his knowledge with other staff and motivating them to be “eyes and ears” for energy efficiency opportunities. The participant assesses the costs and benefits of the projects he and other staff identify and makes recommendations to management. The participant and the staff then implement the approved projects. As the class participant’s supervisor remarked, “Other staff are keeping an eye out and making suggestions all the time. There is a long list of energy savings projects to be done.”

Personal and Professional Benefits for Participant:

- The knowledge, skills, and confidence to become a leader in identifying, analyzing, prioritizing, and implementing energy efficiency projects at his facility, including the development of web-based energy monitoring.
- Further development of managerial skills in motivating other staff to identify and help implement energy efficiency projects.
- The opportunity to become a full-time energy manager.
- Presentation skills and confidence. Has presented on energy efficiency opportunities and projects to the Wastewater Group staff, to the Association of Professional Energy Managers (APEM), and to Bureau of Environmental Services managers. Has offered to give presentations to and work with other City bureaus.
- Recognition and encouragement by his supervisor and other staff in the Wastewater Group. Recognition of energy efficiency projects in the wastewater group's newsletter *UpFront*, including recognition as the 2002 *Value Statement Award* winner for the Wastewater Group.